MENU STRUCTURE AND ORDERING OF MENU SELECTIONS: INDEPENDENT OR INTERACTIVE EFFECTS?

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INTRODUCTION

The breadth/depth trade-off in menu structure refers to advantages and disadvantages of menu breadth (having fewer levels/pages of menu selections with more selections per level) and depth (having more levels/pages with fewer selections per level). Several studies (Snowberry, Parkinson & Sisson, 1983; Landauer & Nachbar, 1985) demonstrate enhanced user performance with increased breadth. However, other studies (Miller, 1981; Kiger, 1984; Tullis, 1985) fail to show an advantage in user performance with increased depth. Complicating the breadth/depth issue is the issue of the ordering of selections within each menu level. Snowberry et al. found superiority of breadth only with consistent ordering of selections within levels. Card (1982) reported that alphabetical ordering of selections is superior to functional ("logical") ordering, which in turn is superior to random ordering.

Do users perceive and utilize menu structure independently of ordering, perhaps by first appraising which level must be accessed, then by determining where in that level the goal selection is? Or are structure and ordering interrelated considerations? These hypotheses were tested in an experiment in which menu breadth and ordering were covaried.

METHOD

Twenty military personnel, randomly assigned to conditions, were presented with a hierarchical menu consisting of user-familiar functions to be performed on a prototype system. Breadth (one vs. three levels) and ordering of selections (alphabetical vs. random) were between-subject variables. Participants were initially shown all menu selections and were familiarized with the particular menu structure which was to be presented. Instructions equally emphasized speed and accuracy in responding.

At the beginning of each of 24 trials (eight practice and 16 data trials), each participant was shown a goal function on a display terminal. When the "return" key was pressed, a whole menu (in which all alternatives were listed in one page) or the first page of a paged menu was displayed, and the time from goal presentation to key press (goal retrieval time) was recorded. Alternatives were chosen by moving a cursor (via arrow keys) to a selection, then pressing return. "Back" and "top" alternatives were available on paged menus. The time from initial menu presentation to final key press

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constituted "selection time." (For users presented with paged menus, system response times in traversing between menu levels were subtracted from selection times.) After the final key press, feedback ("correct choice" or "incorrect choice") was displayed for three seconds, then a 12-second intertrial interval ensued. Accuracy was measured by counting the number of correct final selections chosen by each participant.

RESULTS

A 2 x 2 x 2 (structure x ordering x blocks of trials) mixed analysis of variance was performed on each dependent variable. Alpha was set at .05. For each dependent variable, the following statistically significant effects were obtained:

Goal Retrieval Time

1. A main effect of blocks of trials, F(1,32) = 3.54. Goal retrieval time diminished from block 1 (M = 4.3) to block 2 (M = 3.7).

2. A 3-way interaction between structure ordering and blocks of trials, F(2,32) = 4.53 (see Fig. 1).

Goal Selection Time

1. A main effect of menu structure, F(1,16) = 4.76. The mean selection time for users presented with whole and paged structure was 16.4 and 24.0 seconds, respectively.

2. A main effect of blocks of trials, F(1,32) = 8.22. Goal selection time diminished from block 1 (M = 21.8) to block 2 (M.= 18.6).

3. A 3-way interaction between structure, ordering, and blocks of trials, F(2,32) 5.64 (see Fig. 2).

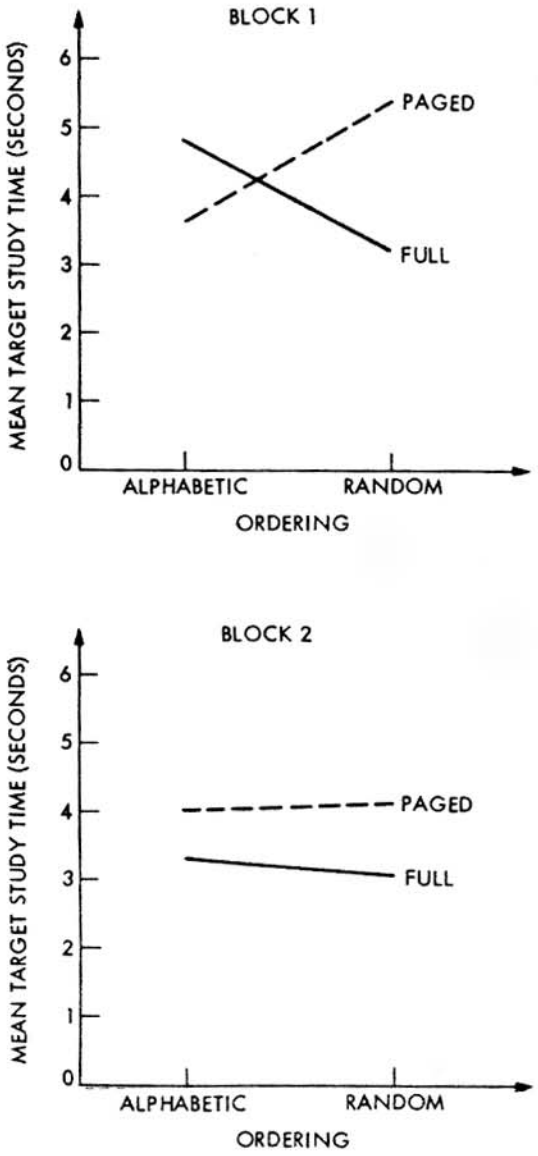

Fig. 1. Mean target study time (goal retrieval time) interaction of trial blocks, structure, and ordering.

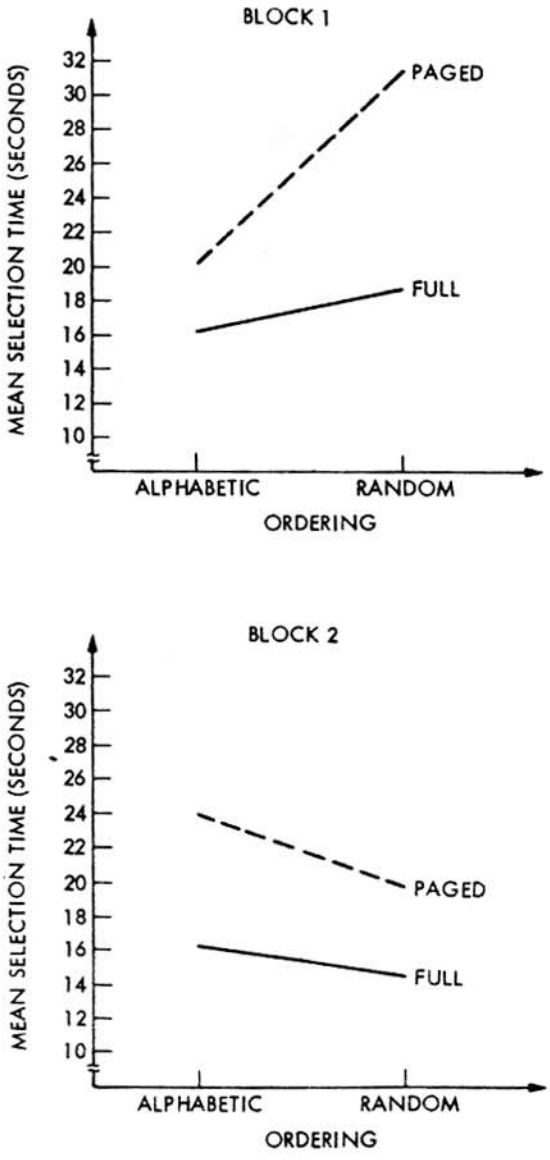

Fig. 2. Mean selection time interaction of trial blocks, structure, and ordering.

Selection Accuracy

1. A 2-way interaction between structure and blocks of trials, $F(1,32) = 3.36$. There was a greater increment in accuracy over trials when a whole menu structure was presented.

CONCLUSIONS

These results provide support for the notion that menu breadth is preferable to depth. The superiority of the whole structure is apparent in virtually every condition investigated in this study, with the one exception of alphabetical ordering in the first block of trials, only with the goal retrieval time measure. Overall, users presented with the whole menu structure wre nearly 50 percent faster in selection goals than were users presented with the paged menu structure. Among the user-reported advantages of a broad menu structure are the following: 1) a broad structure prevents "path errors" resulting from traversing to an incorrect page, and 2) a broad structure enables users to visually scan selections, thereby minimizing the need to remember which selections are contained within a particular branch.

In contrast, there is no significant overall advantage of alphabetical over random ordering of menu selections. At best, alphabetical ordering is superior to random ordering only during the initial block of trials, and only when a deep structure is presented. However, the finding that structure and ordering interact over blocks of trials demonstrates that structure and ordering effects are not independent. The process of determining which branch (if any) of the menu must be accessed is related to the process of determining where in a given page a particular selection is located. The goal retrieval time data confirm that structure and ordering are interactively related even before motor processes which control menu interactions are initiated.

One practical implication is that the number of pages in a menu should be minimized. Another implication is that if a paged structure is used, it is important to provide users with some kind of orderly arrangement of selections. If a whole structure is used, ordering is not as important; nevertheless, a nonrandom ordering is advisable. Finally, the separation of user performance time into goal retrieval and goal selection times (as illustrated in this study) appears to be a useful tool for further investigation of menu variables which produce optimal user performance.

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